DISCRETE CONSERVATION PROPERTIES IN CFD
TRACK 600

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ABSTRACT

Numerical methods with discrete conservation properties have found enormous application in compu-
tational fluid dynamics (CFD). The main reason for their success lies in a powerful combination of
physical fidelity and numerical robustness, making them ideal candidates for the simulation of complex
multi-scale problems, such as shock-free turbulence. Most CFD techniques possess inherent conserva-
tion properties for primary unknowns, while so-called secondary conservation statements are typically
harder to achieve, and consist into the discrete reproduction of evolution equations for derived quantities
that can be deduced from the continuous formulation. A prominent example is kinetic energy in both
incompressible and compressible flow models [1, 2], but other variables such as enstrophy, vorticity or
entropy have proved to be no less important. As the key ingredients to achieve these properties are more
clearly identified, the CFD community is heading towards a unified approach that encompasses a wide
range of techniques, from classical finite-differencing methods to emerging high-order approaches, with
remarkable repercussions on the viability of complex simulations and on turbulence modeling.

This minisymposium will gather researchers from different CFD-related disciplines working on the de-
v elopment of cutting-edge numerical methods with discrete conservation properties, as well as on the
application of such methods to complex engineering or biological systems. Topics include, but are not
limited to: invariant-preserving algorithms for high-order methods (e.g., discontinuous Galerkin, spec-
tral element), mimetic methods, geometric time integration, boundary conditions, implicit and explicit
large-eddy simulation modeling, unstructured and moving grids, high performance computing.

REFERENCES

[1] Coppola, G., Capuano, F. and de Luca, L. Discrete Energy-Conservation Properties in the Numeri-

preserved discretization of Navier-Stokes equations on collocated unstructured grids. J. Comput.